UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/829,136	04/21/2004	Hee-hwan Choe	8116-1 (PL0026/US)	5461

22150 7590 10/18/2005

F. CHAU & ASSOCIATES, LLC
130 WOODBURY ROAD
WOODBURY, NY 11797

EXAMINER	
DHINGRA, RAKESH KUMAR	
ART UNIT	**PAPER NUMBER**
1763	

DATE MAILED: 10/18/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/829,136	CHOE ET AL.	
	Examiner	Art Unit	
	Rakesh K. Dhingra	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *03* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08/04/05*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-7* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-7* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 3, 5 are rejected under 35 U.S.C. 102 (e) as anticipated by Suemasa et al (US Patent N0. 6,642,149).

Regarding Claim 1: Suemasa et al teach a plasma processing apparatus 100 (Figure 1) comprising:

a processing chamber 102 with a lower electrode 106 and an upper electrode 108;

a first high frequency power supply (main power supply) 114 comprising a first power source 122 and a first matching device 120;

a second high frequency power supply (bias) 116 composed of a second power source 128 and a matching device 126;

Suemasa et al further teach a power supply device (mixer) 112 that receives and superimposes the outputs of the first and second high frequency power supplies 122 and 128 through their respective matching circuits 120, 126 and couples the same to the lower electrode 106 (Paragraphs 0019, 0020, 0035).

Regarding Claim 3: Suemasa et al teach that the power supply device 112 (mixer) combines the outputs of the first and second high frequency power supplies 114 and 116 by superimposing (adding) and which is then coupled to the lower electrode 106 for

supplying a superimposed power of the two frequencies coming from the first and second high frequency power supplies 122, 128 respectively (Paragraphs 0020, 0035). Regarding Claim 5: Suemasa et al teach a second high frequency supply 116 for producing a high frequency power component, which is lower than the first high frequency power component supplied by the first high frequency power supply 114 (Paragraph 0020).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-7 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Donohoe et al (US Patent No. 6,309,978 B1) in view of Quon et al (Pub No. US 2003/0094239 A1).

Regarding Claim 1: Donohoe et al teach a plasma chamber 101 (Figure 4) comprising a lower electrode 102 and an upper electrode 103, and used for etching/deposition comprising:

a multi-frequency RF source 114 connected to lower electrode 102 (Column 5, lines 20-38). Donohoe et al further teach that the multi-frequency source 114 (per Figure 6) that includes three frequency generators 31, 32, 33 and which may provide discrete frequency and discrete power levels (Figure 7 and Column 6, lines 14-17). Donohoe et al also teach that the apparatus further includes a mixer 37 which combines the output signals of three frequency generators 31, 32, 33 and provides output signal 30 (having a beat component) to the lower electrode 102 (column 6, lines 5-13).

Donohoe et al do not teach impedance matching circuits.

Quon et al teach a plasma apparatus 20 (Figure 3A) comprising a process chamber with a wafer supporting chuck (Lower electrode) 18;

a very high frequency generator 14 and a VHF match network 30;

a low frequency RF generator 16 (for bias) and a low frequency RF match network 32;

a combiner circuit (mixer) 34 that adds (superposes) the respective RF and VHF signals and a coupling circuit 12 which combines the VHF and the RF signals at the chuck, while maintaining impedance match between VHF and RF generators and the load (Paragraphs 0022, 0023, 0024).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use impedance matching circuits as taught by Quon et al in the apparatus

of Donohoe et al to provide a matched RF signal to the lower electrode (Paragraph 0024).

Regarding Claim 2: Donohoe et al teach that plasma generation is facilitated by the multi-frequency RF source 114 that includes three frequency generators 31, 32, 33 whose frequencies interfere with each other to produce beat which produces a modulated-bias plasma and the multi-frequency RF source includes a mixer 37 which combines the output of three frequency generators 31, 32, 33 and supplies the output signal 30 to the lower electrode 102 (Figures 4, 6, 7 and Column 5, lines 25-30).

Regarding Claims 3, 4: Donohoe et al teach that for mixer 37 summing junction (adding) is preferred for the high frequencies used for plasma generation (Column 6, lines 30-35).

Regarding Claims 5, 6: Donohoe et al also teach (Figure 7) that the three frequencies can be different.

Regarding Claim 7: Donohoe et al in view of Quon et al teach all limitations of the claim as explained above. Further Quon et al teach that filters in the combiner circuit (mixer) 34 prevents the main power source and the bias power source from being directly connected to the lower electrode for simultaneously supplying AC power from the main and bias power sources to the lower electrode (Paragraph 0024).

Claims 2, 4, 6, 7 are rejected under 35 U.S.C. (a) as being unpatentable over Suemasa et al (Patent No. 6,642,149) in view of Donohoe et al (US Patent No. 6,309,978 B1).

Regarding Claim 2: Suemasa et al teach all limitations of claim 1 (as explained above) except for the auxiliary power supply.

Donohoe et al teach a plasma generation apparatus (Figure 4) comprising a process chamber 101 with a pair of RF electrodes 102, 103, showing the lower electrode 102 connected to a multi-frequency RF source 114 that includes a mixer 37, which combines the output of three frequency generators 31, 32, 33 to provide the output signal 30 which is coupled to the lower electrode 102 (Figure 6 and Column 6, lines 6-14).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to utilize three frequencies to produce beat and produce a modulated-bias plasma, as taught by Donohoe et al in the apparatus of Suemasa et al to enable a more efficient process due to higher ion energy for etching and improvement in power consumption.

Regarding Claim 4: Donohoe et al teach that for mixer 37 summing junction (adding) is preferred for the high frequencies used for plasma generation (Figure 6 and Column 6, lines 30-35).

Regarding Claim 6: As explained above, Donohoe et al also teach (per Figure 7) that the three frequencies can be different.

Regarding Claim 7: Donohoe et al in view of Suemasa et al teach all limitations of the claim as explained above. Further Suemasa et al teach that filters circuits 118, 124 in the power supply (mixer) 112 prevent the main power source and the bias power source from being directly connected to the lower electrode for simultaneously supplying AC

power from the main and bias power sources to the lower electrode (Paragraphs 0020, 0036).

Response to Arguments

1) Applicant's arguments, regarding rejection of Claims 1-6 under 35 U.S.C. 102(b) as being anticipated by Donohoe et al (US Patent No. 6,309,978) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made for Claims 1-6 under 35 U.S.C. 103 (a) as being unpatentable over Donohoe et al (US Patent No. 6309978 B1) in view of Quon et al (Pub No. US 2003/0094239 A1) as explained above.

2) Applicant's arguments, regarding rejection of Claims 1, 3, 5 under 35 U.S.C. 102(e) as being anticipated by Quon et al (US Pub. No. 2003/0094239) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made for Claims 1, 3, 5 under 35 U.S.C. 103 (a) as being unpatentable over Donohoe et al (US Patent No. 6309978 B1) in view of Quon et al (US Pub. No. US 2003/0094239 A1) as explained above.

3) Applicant's arguments filed regarding rejection of Claims 1, 3, 5 under 35 U.S.C. 102(e) as being anticipated by Suemasa et al (US Patent No. 6,309,978) have been fully considered but they are not persuasive due to the following:

Applicant argues that Suemasa et al do not disclose or suggest "a mixer which receives and mixes a main voltage and a bias voltage to one of a lower electrode and an upper electrode" as recited in claim 1.

Examiner responds that Suemasa et al teaches that power supply device 112 (Figure 1) superimposes (mixes) the output from the first and second power supply sections 114, 116 and supplies the superimposed power to the lower electrode 106 thus indicating that claim1 is anticipated by Suemasa et al.

In view of above, applicant's argument is not persuasive and the rejection of claim 1 and its dependent claims 3, 5 is maintained.

4) Applicant's arguments regarding rejection of Claims 2, 4, 6 under 35 U.S.C. 103(a) as being unpatentable over Quon et al (Pub No. US 2003/0094239 A1) in view of Donohoe et al (US Patent No. 6,309,978) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made for Claims 2, 4, 6 under 35 U.S.C. 103 (a) as being unpatentable over Donohoe et al (US Patent No. 6,309,978 B1) in view of Quon et al (Pub No. US 2003/0094239 A1) as explained above.

5) Applicant's arguments regarding rejection of Claims 2, 4, 6 under 35 U.S.C. 103(a) as being unpatentable over Suemasa et al (US Patent No. 6,642,149) in view of Donohoe et al (US Patent No. 6,309,978) have been fully considered but are not found persuasive due to the following:

Examiner has already responded to the applicant's arguments regarding Claims 1, 3, 5 (per Suemasa et al) and since Claims 2, 4, 6 are dependent claims their rejection is therefore maintained.

6) Regarding new Claim 7: This claim has been rejected under 35 U.S.C. 103(a) as being anticipated by Donohoe et al in view of Quon et al and also by Suemasa et al in view of Donohoe et al, as explained above.

In view of above, rejection of Claims 1-7 is made final.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a). A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rakesh K. Dhingra whose telephone number is (571)-272-5959. The examiner can normally be reached on 8:30 -6:00 (Monday - Friday). If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571)-272-1435. The fax phone

number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Rakesh Dhingra

Parviz Hassanzadeh
Supervisory Patent Examiner
Art Unit 1763